On Orbit Immuno-Based, Label-Free, White Blood Cell Counting System with MicroElectroMechanical Sensor (MEMS) Technology (OILWBCS-MEMS), Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

Aurora Flight Sciences Corporation and our partner, Draper Laboratory, propose to develop an on orbit immuno-based, label-free, white blood cell counting system for simultaneous counting of peripheral blood cell subpopulations, including total white blood cells, the five white blood cell differential subgroups, and various lymphocyte subtypes, such as CD4 and CD8 positive cells, using Draper's MicroElectroMechanical Sensor (MEMS) based microfabricated arrayable Adhesive Stress Electrostatic Sensor (ASES) technology. The proposed ASES sensor uses a capacitance read-out method to electronically measure the sensor membrane displacement due to the surface stress caused by molecular binding, (e.g., antibody-antigen binding). Antibodies specific to the white blood cell surface protein markers (antigens) are precoated on the ASES sensor membrane to recognize the specific white blood cell types with inherently high specificity and sensitivity. Our proposed cell counting system can meet NASA's requirements for a microgravity compatible, miniaturized, light weight peripheral blood cell counting instrument capable of on-orbit cell counting, without high energy lasers, requiring minimal sample volume or exogenous (sheath) fluid to operate, and generating minimal biohazardous waste. This ASES blood cell counting system, once developed, can stand alone for white blood cell differential and subtype count, or become a complimentary instrument to others available on-orbit.

Anticipated Benefits

Besides NASA's on orbit application, the proposed white blood cell counting system could be used to perform immuno-based cell counting similar to that done by flow cytometers. In general, any existing immuno-based cell counting performed for research and development, could potentially be accomplished with our proposed approach. The benefits of our proposed ASES cell counting system include high specificity and sensitivity for simultaneous counting of multiple cell types, compact size (the size of a cell phone), low power consumption, and full automation.

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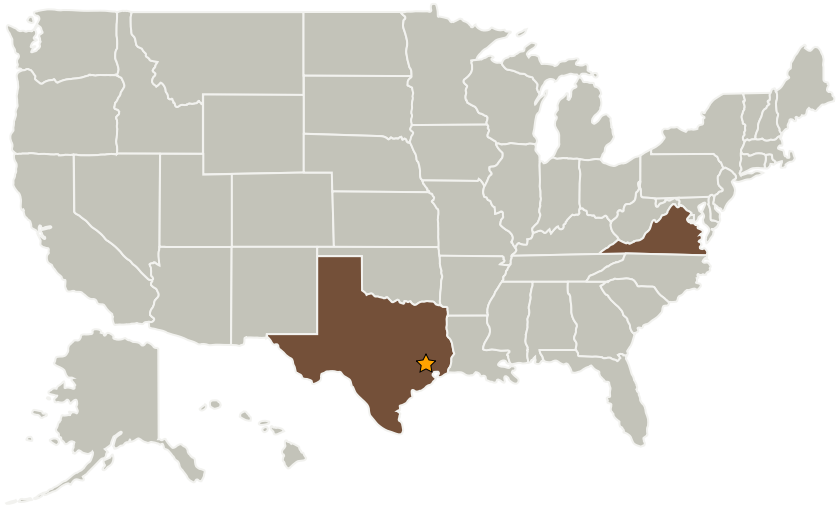
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Aurora Flight Sciences Corporation	Supporting Organization	Industry	Cambridge, Massachusetts

Primary U.S. Work Locations	
Texas	Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Dan L Feeback

Principal Investigator:

Liping Sun

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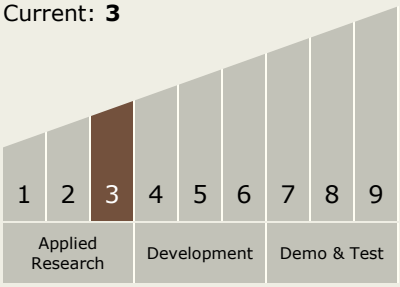
Technology Maturity (TRL)

Start: **3**
Current: **3**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.2 Electrochemical: Fuel Cells